REMARKS

Applicant respectfully requests reconsideration of this application as amended. Claims 1-52 are pending in the application. Claims 1, 8, 12, 13, 17, 22, 23, 32, 39, and 42 have been amended. No claims have been added. No claims have been canceled.

The Examiner rejected Claims 1, 4-8, 12-13 and 15-38 under 35 U.S.C. §103 as being unpatentable over Shapiro, "Embedded Image Coding Using Zero Trees of Wavelet Coefficients" in view of Woods, "Subband Image Coding", and Ormsby, et al. The present invention as claimed in Claim 1 requires an overlapped reversible wavelet transform be applied to input data. As claimed, the reversible transform is implemented in integer arithmetic such that, with integer coefficients, input data is losslessly recoverable. That is, a signal with integer coefficients may be losslessly recovered. Neither Shapiro, Woods nor Ormsby sets forth an overlapped reversible wavelet transform of this type. Therefore, their combination cannot render the present invention obvious.

The Examiner states that Shapiro can use various different conventional well known filters of Woods since they both provide for quadrature mirror filters (QMFs) filters. However, the fact that a transform is implemented as a quadrature mirror filter does not make it reversible. The Examiner also discusses where the number of taps correspond to the length of filters in that a QMF may consist of one pair of filters with various different filter lengths. However, varying the number of taps in itself does not result in a reversible wavelet

transform as set forth in the claims. Certain rounding is required to obtain an overlapped reversible wavelet transform and Shapiro does not teach such rounding.

Furthermore, it appears the Examiner may be confusing perfect reconstruction with reversibility. Perfect reconstruction is a property that applies when using infinite precision floating point numbers. However, infinite precision floating point numbers are not available in practical applications. Shapiro can not obtain perfect reconstruction (although he attempts to do so). On the other hand, the present invention as claimed sets forth a reversible wavelet transform implemented in integer arithmetic such that input data is losslessly recoverable with integer coefficients. Such reversibility does not involve the use of infinite precision floating point numbers, but instead deals with integers. In view of the above, Applicant respectfully submits that the combination of Shapiro, Woods and Ormsby does not set forth the claimed reversible transform and, therefore, the combination cannot render obvious the present invention as claimed.

Moreover, Claim 1 sets forth that the context modeling of bits of coefficients generated by the claimed overlapped reversible wavelet transform is based on known coefficients and other frequency band and neighboring coefficients in the same frequency band. However, the Examiner fails to show why one skilled in the art confronted with the same problem as that with the present invention would look to Shapiro and Ormsby and combine the two.

Applicant maintains his objection to the combination of Shapiro and Ormsby. One of ordinary skill in the art would not be motivated to include Ormsby's arithmetic coder in the Shapiro system and the combination would still not give the present invention as claimed.

Therefore, Applicant respectfully submits that one skilled in the art would not combine the teachings of Ormsby with that of Shapiro. It appears the Examiner is doing no more than using hindsight to select different items from a variety of references in an attempt to create a combination. This is clearly not permissible. In view of this, Applicant respectfully submits the present invention as claimed is not obvious in view of the combination of Shapiro, Woods and Ormsby.

The Examiner rejected Claims 39-40 and 42 under 35 U.S.C. §103 as being unpatentable over Shapiro in view of Woods. Applicant respectfully submits that the reversible 2,10 wavelet transform as claimed is not shown in either of the references and is not considered a filter that is conventional and specifically the fact that no filter in Shapiro or Woods is a reversible 2,10 variable wavelet filter. Therefore, Applicant respectfully submits that the present invention as claimed in Claims 39-40 and 42 is not obvious in view of Shapiro and Woods.

The Examiner rejected Claim 41 and 43 under 35 U.S.C. §103 as being unpatentable over Shapiro, Woods and Ormsby. For the same reasons as given above with respect to Claims 39-40 and 42, the present invention as claimed is not obvious in view of Shapiro, Woods and Ormsby.

The Examiner also rejected Claims 25-31 under 35 U.S.C. §103 as being unpatentable over Shapiro, Woods, Ormsby and further in view of Hartung, et al. or Shinichi. Applicant respectfully submits that neither Hartung nor Shinichi sets forth a reversible 2,10-transform. In view of this, Applicant submits that the present invention is not obvious in view of the cited combination for the same reasons set forth above.

Examiner rejected Claims 39-40 and 42 under 35 U.S.C. §103 as being unpatentable over Shapiro in view of Woods or in the alternative in view of Woods, and further in view of Hartung, et al. or Shinichi. Applicant respectfully submits that the present invention as claimed is not obvious in view of the combination of either of the cited combinations for the same reasons set forth above.

The Examiner rejected Claims 41 and 43 under 35 U.S.C. §103 as being unpatentable over Shapiro, in view of Woods and either Hartung or Shinichi and further in view of Ormsby. Applicant respectfully submits the present invention as claimed sets forth reversible wavelet transforms. These are not disclosed in these references. Therefore, Applicant respectfully submits that the present invention is not obvious in view of the cited combination.

Accordingly, Applicant respectfully submits that the rejections under 35 U.S.C. §103(a) have been overcome by the amendments and the remarks and withdrawal of these rejections is respectfully requested. Applicant submits that

Claims 1, 6-8, 12, 13, 16, 17, 33-36, and 44-52 as amended are now in condition for allowance and such action is earnestly solicited.

Please charge any shortages and credit any overcharges to our Deposit Account No. 02-2666.

Respectfully submitted,
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Dated: April 18, 2001

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Five Times Amended) A method for encoding input data comprising:

applying an overlapped reversible wavelet transform to the input data to produce a series of coefficients, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that with integer coefficients, integer input data is losslessly recoverable; and

compressing the series of coefficients into data representing a compressed version of the input data, including context modeling bits of each of the series of coefficients based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band.

8. (Four Times Amended) A method for decoding data into original data comprising:

decompressing a compressed version of input data into a plurality of transformed signals, including context modeling bits of the plurality of transformed signals based on known transformed signals in other frequency bands and neighboring transformed signals in the same frequency band; and

generating a reconstructed version of original data from the plurality of transformed signals with an overlapped inverse reversible wavelet transform, wherein the overlapped inverse reversible wavelet transform is implemented in

integer arithmetic such that data with integer coefficients, integer reconstructed original data is losslessly recoverable.

12. (Four Times Amended) A method for processing input data comprising:

generating a first plurality of transformed signals in response to the input data with a reversible overlapped wavelet transform using a first pair of non-minimal length reversible filters, implemented in integer arithmetic such that with integer signals, integer input data is losslessly recoverable;

compressing the first plurality of transformed signals into data representing a compressed version of the input data, including context modeling the first plurality of transformed signals based on known transformed signals in other frequency bands and neighboring transformed signals in the same frequency band;

decompressing the compressed version of the input data into a second plurality of transformed signals; and

generating the input data from the second plurality of transformed signals into a reconstructed version of the input data with an inverse reversible overlapped wavelet transform using a second pair of non-minimal length reversible filters.

13. (Four Times Amended) A method for encoding input data comprising:

transform coding the input data into a series of coefficients with an overlapped reversible wavelet transform, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that with integer coefficients, integer input data is losslessly recoverable; and

embedded coding the series of coefficients, including the steps of ordering the series of coefficients, performing bit significance embedding on the series of coefficients, wherein a first type of embedded coding is performed on a first portion of the data and a second type of embedded coding is performed on a second portion of the data using context modeling based upon known coefficients in other frequency bands and neighboring coefficients in the same frequency band.

17. (Four Times Amended) A method for encoding input data comprising:

transforming input data into a series of coefficients with an overlapped reversible wavelet transform, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that with integer coefficients, integer input data is losslessly recoverable;

converting the series of coefficients into sign-magnitude format to produce a series of formatted coefficients;

coding a first portion of the series of coefficients using a first type of embedded coding to produce a first bit stream;

coding a second portion of the series of formatted coefficients using a second type of embedded coding that models data using known coefficients in other frequency bands and neighboring coefficients in the same frequency to produce a second bit stream; and

coding the first bit stream and second bit stream into a single bit stream.

22. (Amended) An encoder for encoding input data into a compressed data stream, said entropy coder comprising:

a reversible wavelet filter for transforming the input into a plurality of coefficients<u>, wherein the reversible wavelet filter is implemented in integer arithmetic such that with integer coefficients, integer input data is losslessly recoverable</u>;

an embedded coder coupled to <u>the</u> [a] reversible wavelet filter for performing embedded coding on the plurality of coefficients to generate a bit stream, when the embedded coder comprises a context model to model data based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band; and

an entropy coder coupled to the embedded coder to perform entropy coding on the bit stream to create coded data.

23. (Amended) An encoder for encoding input data comprising:

a transform coder coupled to receive the input data and generate a series of coefficients that represent a decomposition of the input data using an overlapped reversible wavelet transform, wherein the overlapped reversible wavelet transform is implemented in integer arithmetic such that with integer coefficients, integer input data is losslessly recoverable; and

an embedded coder coupled to receive the series of coefficients and perform bit-significance encoding on the series of coefficients to create coded data, when the embedded coder comprises a context model to model data based on known coefficients in other frequency bands and neighboring coefficients in the same frequency band, the embedded coder producing the coded data as the series of coefficients are received.

32. (Twice Amended) A decoder for decoding input data comprising:

a decompressor to decompress a compressed version of input data into a plurality of coefficients using context modeling based on known coefficients in other frequency bands and neighboring coefficients in the same frequency; and

an overlapped inverse reversible wavelet transform coupled to the decompressor to generate a reconstructed version of original data from the plurality of coefficients, wherein the overlapped inverse reversible wavelet transform is implemented in integer arithmetic such that data with integer coefficients, integer reconstructed original data is losslessly recoverable.

39. (Twice Amended) A system comprising:

a reversible Two/Ten [variable] wavelet filter, wherein the reversible Two/Ten wavelet filter is implemented in integer arithmetic such that with integer coefficients, an integer signal is losslessly recoverable; and

a coder coupled to the Two/Ten filter to code coefficients generated by the Two/Ten wavelet transform filter.

42. (Amended) A decoding system comprising:

a decoder to decode compressed data into a series of coefficients; and

an inverse Two, Ten reversible wavelet filter coupled to the decoder, wherein the inverse Two, Ten reversible wavelet transform is implemented in integer arithmetic such that with integer coefficients, integer reconstructed original data is losslessly recoverable.